AMENDMENTS TO THE DRAWINGS

Replacement sheets showing Figs. 2 and 11 are enclosed, along with annotated sheets showing the amendments to Figs. 2 and 11.

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REMARKS

By this amendment, Claims 1, 52, 57, and 78 have been amended and no claims have been cancelled or added. Accordingly Claims 1-78 are presently pending and favorable consideration thereof is respectfully requested.

Claim 1 has been amended to correct a typographic error by replacing "for a at least part of a first period of time" with "for at least part of a first period of time." Claim 52 has been amended to correct a typographic error by adding the phrase "said stored user input to determine said first period of time." Claim 57 has been amended to replace "The method of claim 56" with "The apparatus of claim 56."

The specification has been amended to correct two minor typographical errors on page 9 and to make an editorial change on page 11.

FIGURE 2 of the drawings has been amended to add a missing reference numeral "26" and the text "CONTROLLER," which had been inadvertently omitted. FIGURE 11 has been amended to correspond to the specification at page 20, line 30, by replacing the symbol ">" in block 201 with the symbol "≥"

Title of the Invention

The Examiner has objected to the title of the invention as not being descriptive. Applicant does not understand how the title fails to be clearly indicative of the invention to which the claims are directed and respectfully requests that the Examiner provide guidance as to how the title of the invention may be satisfactorily amended.

Claim Rejections Under 35 U.S.C. § 102

The Examiner has rejected Claims 1-6, 15-19, 24-30, 38-43, 53-56, 61-67, and 75-78 under 35 U.S.C. § 102(b) as being anticipated by Cummings et al. (U.S. Patent No. 6,194,867). The standard for an anticipation rejection under 35 U.S.C. § 102 has been well established by the

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Court of Appeals for the Federal Circuit, and is set forth in M.P.E.P. § 2131, which provides that a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. In addition, the identical invention must be shown in as complete detail as is contained in the claim. For a prior art reference to anticipate a claimed invention, every element of the claimed invention must be identically shown in a single reference, and these elements must be arranged as in the claim under review.

The Examiner states in the Office Action on page 2, that "The reference discloses a charger for a plurality of batteries wherein the lowest charged battery is charged until all batteries are charged. See FIGURE 4. Programs are employed as charging procedures." Applicant submits that the Examiner has equated nothing in the Cummings et al. disclosure that corresponds to the language of applicant's claims.

Applicant's amended Claim 1 recites:

> 1. A method of charging batteries in a system of batteries, the method comprising:
>
> producing a set of state of charge signals indicative of the states of charge of each battery in the system;
>
> successively identifying, from the state of charge signals, a most discharged battery in the system; and
>
> applying a charging current to the most discharged battery for at least part of a first period of time less than a period of time required to fully charge the most discharged battery before identifying a succeeding most discharged battery in the system.

Cummings et al. fails to disclose "successively identifying, from the state of charge signals, a most discharged battery in the system" and "applying a charging current to the most discharged battery before identifying a succeeding most discharged battery in the system," as recited in applicant's Claim 1.

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Cummings et al. discloses a charging apparatus for multiple batteries that is capable of operating in an independent mode or a simultaneous mode. In the independent mode, the batteries are charged one at a time (Col. 4, lines 34-39). There does not appear to be any disclosure of how successive batteries are identified to be charged in the independent mode. It would appear that no consideration is given to the relative state of charge of the batteries when the disclosed apparatus is operating in the independent mode.

In the simultaneous mode, disclosed by Cummings et al., all the batteries are charged simultaneously unless the apparatus detects a differential charge between any of the batteries, in which case the apparatus discontinues the simultaneous charging of all the batteries and charges only the lowest charged battery or lower charged batteries. When the lower charged batteries have a charge that matches a next lowest charged battery, the apparatus simultaneously charges the lower charged batteries and the next lowest charged battery (FIGURE 4, steps 420-430). When the charges on all batteries match, the apparatus resumes simultaneous charging of all batteries.

Applicant's Claim 1 recites successively identifying a most discharged battery. "Successively" means "characterized by or produced in succession" and "succession" means "the act or process of following in order: sequence" (Webster's Ninth New Collegiate Dictionary).

Applicant's claim language implies a sequence or succession of: identifying a most discharged battery, applying a charging current to the most discharged battery for at least part of a first period of time, and then identifying a succeeding most discharged battery in the system. In other words, after a most discharged battery is charged for a first period of time, the state of charge signals are again checked to determine which battery in the system is now the most discharged battery. Charging current is then applied to only the most discharged battery before the state of charge signals are again checked to determine whether or not there is a new most

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discharged battery (see applicant's FIGURE 9). Consequently in applicant's system, only one battery is charged at a time.

The sequence of checking for the most discharged battery and then applying charging current to it for a period of time before identifying a succeeding most discharged battery, means that the batteries are not charged continuously, but rather are charged a little at a time. More particularly, the most discharged battery is charged for a period of time, then charging stops, then the state of charge signals are used to identify the most discharged battery, then that most discharged battery is charged. This is given by the language "successively identifying" and "before identifying a succeeding most discharged battery." Since there is a successive identification of the most discharged battery, the charging period is not dependent upon the relative state of charge of the batteries in the system, but rather on the time between successively identifying.

As recited in later claims, the period of time during which the most discharged battery is charged may be dependent on a number of factors including battery types and loads, for example (see specification) and is not dependent upon the state of charge of any other battery in the system. In applicant's claimed system, the states of charge are determined in succession with charging in between, and the period of time for charging is not dependent on the relative states of charge of batteries in the system.

Cummings et al. describes a system in which the decision of whether or not a battery receives charging current is dependent upon the relative state of charge of the battery, and the period during which the battery is charged is also dependent upon the relative state of charge of the battery.

In applicant's system, the relative state of charge determines whether or not a battery will receive a charging current but the period of time during which charging current is supplied is

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independent of the relative state of charge and is only dependent upon properties of the battery being charged and the load it faces.

A difference between applicant's claimed method and the method disclosed by Cummings et al. can be readily appreciated by considering an example in which three batteries B1, B2, and B3 are charged by each system, battery B1 having the highest charge, battery B2 having an intermediate charge, and battery B3 having a lowest charge.

The apparatus disclosed by Cummings et al. would detect that B3 has the lowest charge and would charge only B3 until it had the same charge as B2. Then the apparatus would simultaneously charge both B2 and B3 until these batteries had the same charge as B1. The apparatus would then simultaneously charge B1, B2, and B3. Thus, the load on the battery charger increases, as more batteries are simultaneously charged.

In contrast, applying applicant's method, the battery B3 would be identified as the most discharged battery and would be charged for a first period of time. At the end of the first period of time the state of charge of batteries B1, B2, and B3 would again be produced. If the charging current applied to B3 was sufficient to raise the charge of B3 above the charge of B2, then B2 will be the most discharged battery and will be the next battery to receive the charging current. If, however, the charge applied to B3 was insufficient to raise the charge of B3 above the charge of B2, then B3 will again be the most discharged battery and will receive the charging current. Only one battery is charged at any given time, and thus the load on the battery charger is not increased.

Thus, applicant's method produces a substantially different charging sequence than the apparatus disclosed by Cummings et al. for the reason that Cummings et al. fails to disclose "successively identifying, from the state of charge signals, a most discharged battery in the system," as recited in applicant's Claim 1. By failing to identify a most discharged battery,

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Cummings et al. permits batteries to be simultaneously charged. In contrast, applicant's system always identifies a most discharged battery, and consequently only one battery receives charging current at any given time. The load on the battery charger is always only the load of one battery circuit at a time, and never more than one battery circuit at a time. The applicant's system also does not require the batteries to supply the same load and, in fact, the batteries can be connected to different loads because only one battery is charged at a time due to the successive nature of identifying the most discharged battery and charging it before identifying the most discharged battery at a next succeeding time. Not only can the batteries be connected to different loads, they can be supplying current to those loads at the same time they are being charged.

In view of the above, applicant submits that Cummings et al. fails to disclose "successively identifying, from the state of charge signals, a most discharged battery in the system" and "applying a charging current to the most discharged battery for at least part of a first period of time less than a period of time required to fully charge the most discharged battery before identifying a succeeding most discharged battery in the system," as recited in applicant's amended Claim 1. Consequently Cummings et al. fails to disclose every element of applicant's amended Claim 1, and therefore the cited reference fails to satisfy the test for anticipation. Applicant therefore submits that amended Claim 1 is not anticipated and the Examiner's rejection is improper and should be withdrawn.

Claims 2-37 are all ultimately dependent on amended Claim 1 and should be allowable due to their dependency and due to the additional subject matter these claims recite.

Claim 38 recites:

> 38. An apparatus for charging batteries in a system of batteries, the apparatus comprising:

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a state of charge signal generator operable to produce state of charge signals indicative of the states of charge of each battery in the system;

a power supply operable to produce a charging current;

a current distributor operable to selectively connect each battery in the system to the power supply in response to a control signal;

a controller configured to:

communicate with the state of charge signal generator to successively produce a set of the state of charge signals indicative of the states of charge of each battery in the system;

successively identify, from the set of state of charge signals, a most discharged battery in the system; and

produce the control signal to cause the current distributor to selectively connect the most discharged battery to the power supply such that the most discharged battery receives the charging current from the power supply for at least part of a first period of time less than a period of time required to fully charge the most discharged battery, before identifying a succeeding most discharged battery in the system.

Cummings et al. fails to disclose an apparatus that includes a controller configured to successively identify, from the set of state of charge signals, a most discharged battery in the system and causing a current distributor to selectively connect the most discharged battery to a power supply such that the most discharged battery receives the charging current from the power supply for at least part of a first period of time less than a period of time required to fully charge the most discharged battery, before identifying a succeeding most discharged battery in the system," as recited in applicant's Claim 38.

For the same reasons set forth in connection with applicant's amended Claim 1, Cummings et al. fails to disclose every element of the applicant's Claim 38, and therefore the cited reference fails to satisfy the test for anticipation. Consequently applicant submits that

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Claim 38 is not anticipated and therefore the Examiner's rejection of the claim is improper and should be withdrawn.

Claims 39-74 are all ultimately dependent on Claim 38 and should be allowable due to their dependency and due to the additional subject matter these claims recite.

Applicant's Claim 75 recites:

> 75. An apparatus for charging batteries in a system of batteries, the apparatus comprising:
>
> means for producing a set of state of charge signals indicative of the states of charge of each battery in the system;
>
> means for successively identifying, from the state of charge signals, a most discharged battery in the system; and
>
> means for applying a charging current to the most discharged battery for at least part of a first period of time less than a period of time required to fully charge the most discharged battery before identifying a succeeding most discharged battery in the system.

Claim 75 is an apparatus claim including elements in means-plus-function format generally corresponding to elements in applicant's amended Claim 1. For the same reasons set forth in connection with applicant's amended Claim 1, Cummings et al. fails to disclose every element of the applicant's Claim 75, and therefore the cited reference fails to satisfy the test for anticipation. Consequently applicant submits that Claim 75 is not anticipated and therefore the Examiner's rejection of the claim is improper and should be withdrawn.

Applicant's Claim 76 recites:

> 76. In a charger for charging batteries in a system of batteries, where the charger comprises a state of charge signal generator operable to produce state of charge signals indicative of the states of charge of each battery in the system, a controllable power supply operable to produce a charging current, a current distributor operable to selectively connect each battery in the system to the power supply in response to a control signal, and a controller operable to communicate with the state of charge signal

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generator, the power supply and the current distributor, a method of operating the controller, the method comprising:

causing the controller to communicate with the state of charge signal generator to produce a set of the state of charge signals indicative of the states of charge of each battery in the system;

causing the controller to successively identify, from the state of charge signals, a most discharged battery in the system; and

causing the controller to produce the control signal to cause the current distributor to selectively connect the most discharged battery to the power supply such that the most discharged battery receives the charging current from the power supply for at least part of a period of time less than a period of time required to fully charge the most discharged battery, before causing the controller to identify a succeeding most discharged battery in the system.

Cummings et al. fails to disclose causing a controller to successively identify, from the state of charge signals, a most discharged battery in the system and causing the controller to produce a control signal to cause a current distributor to selectively connect the most discharged battery to a power supply such that the most discharged battery receives the charging current from the power supply for at least part of a period of time less than a period of time required to fully charge the most discharged battery, before causing the controller to identify a succeeding most discharged battery in the system, as recited in applicant's Claim 76.

For the same reasons set forth in connection with applicant's amended Claim 1, Cummings et al. fails to disclose every element of the applicant's Claim 76, and therefore the cited reference fails to satisfy the test for anticipation. Consequently applicant submits that Claim 76 is not anticipated and therefore the Examiner's rejection of the claim is improper and should be withdrawn.

Applicant's Claim 77 recites:

77. A computer readable medium comprising codes for directing a controller in a charger for charging batteries in a system of batteries,

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where the charger comprises a state of charge signal generator operable to produce state of charge signals indicative of the states of charge of each battery in the system, a controllable power supply operable to produce a charging current and a current distributor operable to selectively connect each battery in the system to the power supply in response to a control signal, and wherein the controller is operable to communicate with the state of charge signal generator, the power supply and the current distributor, the computer readable medium comprising codes readable by the controller for directing the controller to:

communicate with the state of charge signal generator to successively produce a set of the state of charge signals indicative of the states of charge of each battery in the system;

successively identify, from the state of charge signals, a most discharged battery in the system; and

produce the control signal to cause the current distributor to selectively connect the most discharged battery to the power supply such that the most discharged battery receives charging current from the power supply for at least part of a period of time less than a period of time required to fully charge the most discharged battery, before causing the controller to identify a succeeding most discharged battery in the system.

Claim 77 is a computer readable medium claim that includes elements that generally correspond to elements in Claim 76.

For the same reasons set forth in connection with applicant's amended Claim 1 and Claim 76, Cummings et al. fails to disclose every element of the applicant's Claim 77, and therefore the cited reference fails to satisfy the test for anticipation. Consequently, applicant submits that Claim 77 is not anticipated and therefore the Examiner's rejection of the claim is improper and should be withdrawn.

Applicant's amended Claim 78 recites:

78. A method of charging a plurality of batteries, the method comprising charging individual batteries or battery banks in the plurality of batteries one at a time according to a dynamic charging sequence in which batteries or battery banks are added into the charging sequence in order of increasing state of charge as batteries or battery banks already in

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the charging sequence are charged to exceed the state of charge of a battery or battery bank having the next higher state of charge relative to the state of charge of the batteries already in the charging sequence.

Applicant has amended Claim 78 to better define certain aspects of applicant's invention.

Cummings et al. fails to disclose "charging individual batteries or battery banks in the plurality of batteries one at a time according to a dynamic charging sequence in which batteries or battery banks are added into the charging sequence in order of increasing state of charge," as recited in applicant's amended Claim 78.

As stated above in connection with amended Claim 1, in the independent mode disclosed by Cummings et al., the batteries are charged one at a time without consideration of the relative state of charge of the batteries. Consequently, in the disclosed independent mode, batteries are not added to a charging sequence in order of increasing state of charge, as recited in applicant's amended Claim 78.

In the simultaneous mode, disclosed by Cummings et al., when the apparatus detects a differential charge between any of the batteries, only the lowest charged battery or the lower charged batteries receive charging current. When the lower charged batteries have a charge that matches a next lowest charged battery, the apparatus simultaneously charges the lower charged batteries and the next lowest charged battery. When the charges on all batteries match, the apparatus simultaneously charges all batteries. In the disclosed simultaneous mode, once two lower charged batteries have the same charge, the two batteries will be simultaneously charged. Consequently, in the simultaneous mode disclosed by Cummings et al., batteries or battery banks are not charged one at a time according to a dynamic charging sequence.

In view of the above, applicant submits that Cummings et al. fails to disclose "charging individual batteries or battery banks in the plurality of batteries one at a time according to a dynamic charging sequence in which batteries or battery banks are added into the charging sequence in order of increasing state of charge," as recited in applicant's amended Claim 78.

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Consequently, Cummings et al. fails to disclose every element of applicant's Claim 78, and therefore the cited reference fails to satisfy the test for anticipation. Applicant therefore submits that Claim 78 is not anticipated and the Examiner's rejection is improper and should be withdrawn.

Claim Rejections Under 35 U.S.C. § 103

The Examiner has rejected Claims 7-14, 20-23, 31-37, 44-52, 57-60, and 68-74 as being obvious in view of Cummings et al.

The requirements for a *prima facie* case of obviousness have been well established by the Court of Appeals for the Federal Circuit, and are concisely summarized in M.P.E.P. §§ 2142 and 2143, which confirm that three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991).

In connection with applicant's Claims 7 and 44, Cummings et al. fails to disclose or suggest that "said first period of time is such that at least a current state of charge of said most discharged battery is maintained over time." In connection with applicant's Claims 8 and 45, Cummings et al. fails to disclose that "said first period of time is such that at least a current state of charge of said most discharged battery is increased over time." In connection with applicant's Claims 9, and 46, Cummings et al. fails to disclose that "said first period of time is long enough to avoid interference in a load connected to said most discharged battery." In connection with

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applicant's Claims 11 and 49, Cummings et al. fails to disclose "selecting said first period of time in response to a chemical type of said most discharged battery." In connection with applicant's Claims 20 and 57, Cummings et al. fails to disclose a minimum period of time "to avoid interference in a load connected to said most discharged battery."

As explained above, Cummings et al. discloses charging a lower charged battery until the battery's charge matches that of a next lowest charged battery and thus the period of time for which the lowest charged battery is charged is only dependent on the relative state of charge of the batteries in the system.

Applicant's Claims 7-9, 11, 20, 44-46, 49, and 57 are generally directed to further defining the "first period of time," recited in Claims 1 and 38. For example, the first period of time may depend on the current state of charge of the most discharged battery, avoiding interference in a load being supplied by the battery, a chemical type of the most discharged battery, etc.

Accordingly, applicant submits that Cummings et al. fails to disclose or suggest every limitation of applicant's Claims 7-9, 11, 20, 44-46, 49, and 57 and therefore the Cummings et al. reference does not satisfy the test for obviousness and consequently, applicant submits that these claims are not obvious and that the Examiner's rejection is improper and should be withdrawn.

Furthermore, since Claims 10, 12-14, 21-23, 47, 48, 50-52, and 58-60 are all ultimately dependent on either Claim 1 or Claim 38, they should also be allowable due to their dependencies and due to the additional subject matter they recite.

Claims 31-37 and 68-74 are all ultimately dependent on Claim 1 or Claim 38 and should be allowable due to their dependencies and due to the additional subject matter these claims recite, and consequently, applicant submits that Claims 31-37, and 68-74 are not obvious and that the Examiner's rejection of these claims is improper and should be withdrawn.

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Applicant respectfully requests further favorable consideration of the application.

Applicant herewith petitions for an automatic extension of time for one month, from January 6, 2006, to February 6, 2006, for responding to the outstanding Office Action dated October 6, 2005.

The Examiner is invited to telephone the undersigned with any remaining issues regarding this matter.

Respectfully submitted,

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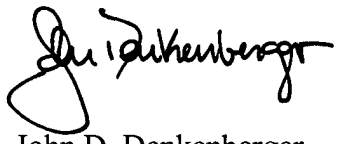

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Date: February 6, 2006 

JDD:cg

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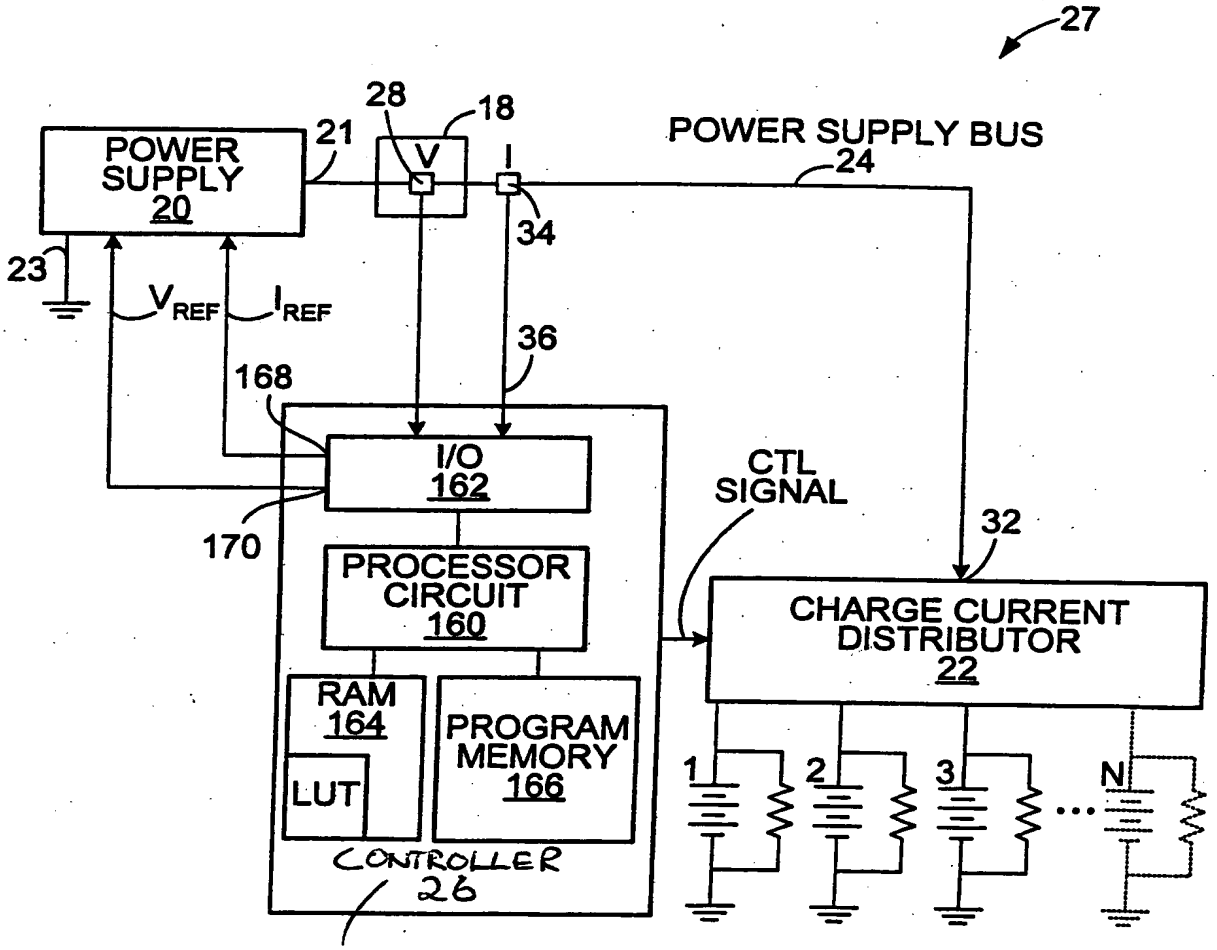

Fig.2.

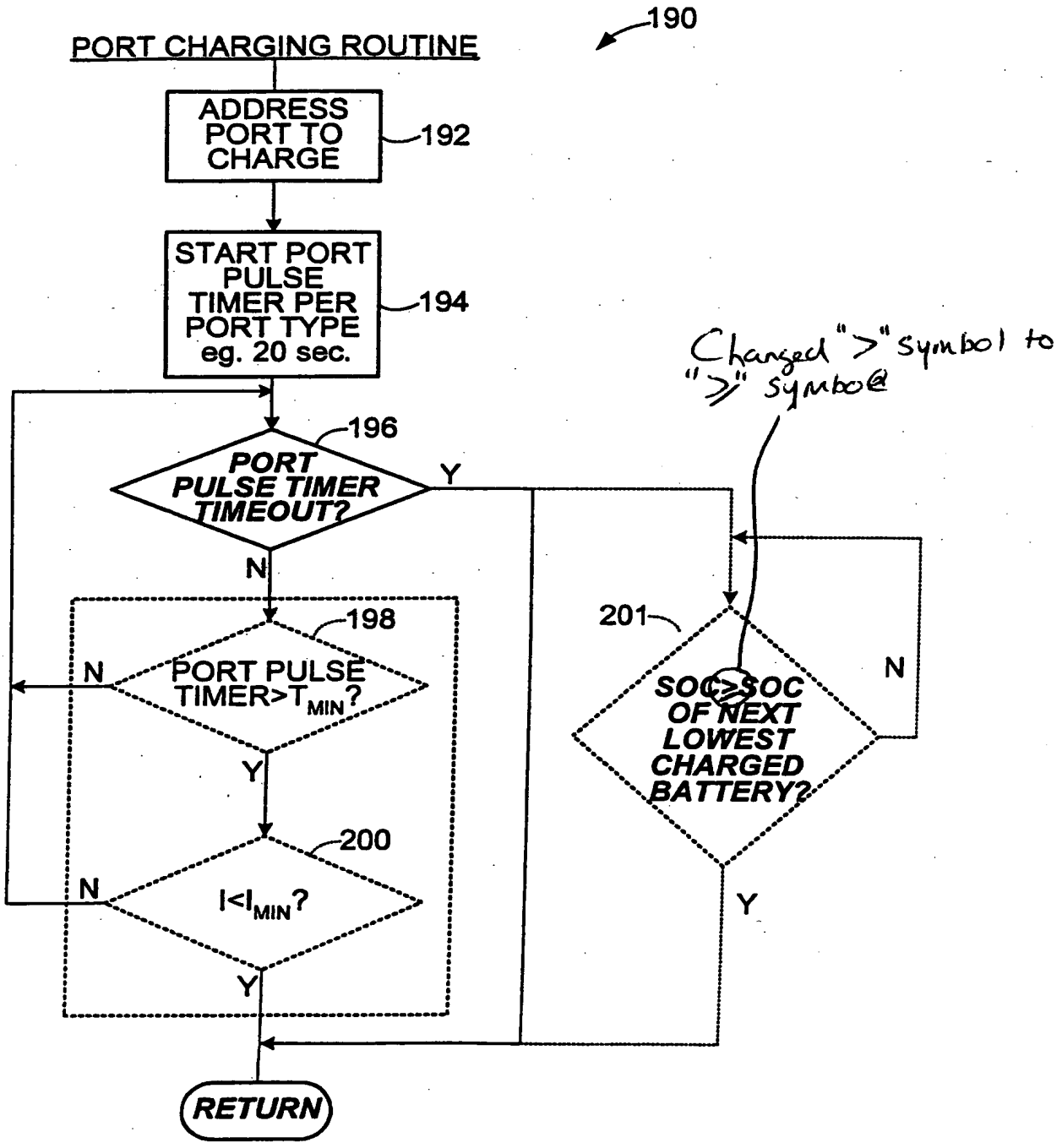
190
PORT CHARGING ROUTINE
ADDRESS PORT TO CHARGE
192
START PORT PULSE TIMER PER PORT TYPE eg. 20 sec.
194
Changed ">" symbol to "≥" symbol
196
PORT PULSE TIMER TIMEOUT?
Y
N
198
PORT PULSE TIMER>T_MIN?
N
Y
200
I<I_MIN?
N
Y
201
SOC≥SOC OF NEXT LOWEST CHARGED BATTERY?
N
Y
RETURN

Fig.11.